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EFFECT OF MELANIN ISOLATED FROM ANTARCTIC YEASTS ON PRESERVATION OF PIG LIVESTOCK AFTER ABLACTATION

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Abstract. Particularly high mortality rate among pigs observed after weaning. The main reason for this phenomenon is the stressful situation. One of the most promising way to prevent the consequences of stress at weaning and aimed to increase the overall resistance of the organism of piglets is the use of biologically active substances in diets. Our data and data of others on the anti-stress effect of melanin were basis for experiments on the use of melanin in the agricultural facilities that specialized in growing pigs. We found that the addition of melanin to piglets' diet during weaning completely abrogated their illness and mortality.
Key words: melanin, stress

1. Introduction

Stress - one of the most important problem of modern animal husbandry. This problem becomes even more pronounce since the increasing of livestock production. Specialization and concentration of animal husbandry, limitations in pasture that accompany scientific and technological revolution in agriculture, have led not only to increase the number of stress factors, but also to the fact that many parts of the cultivation and maintenance of animals come into conflict with the physiological characteristics. In modern industrial facility the animal is influenced by stress factors that are stronger than before. Animals are not only under stress of the artificial environment, but also "social". Industrialization that led to the loss of natural environment, use of intensive technologies, which have caused pollution of the environment and absorbance of foreign compounds by body; enhance of social relationships with large concentrations of animals; changing the nature of insemination; mechanization of production processes excluded the possibility of natural needs for physical activity, daily maintenance of physical strength. Development of feed-reprocessing industry has brought changes in the nature of digestion. Listed factors alter the functions of organism, leading to functional depletion, development of stress condition which results in various functional disorders, reducing resistance of the organism and the increasing of morbidity and mortality.

Particularly high mortality rate among piglets observed at weaning, therefore the problem remains one of the most important in modern pig production. Mostly it is due to some biological features of pigs, amount of milk and larger-fetus in sows, conditions of housing and the genetic potential of animals. Concentration of adaptive hormones, the intensity of metabolism and oxidation of free radicals play crucial role in regulating the process of adaptation in animals [Snitynskyy, 1999]. In literature there are sporadic data that indicate the relationship between the content of certain hormones in the blood and the intensity of lipid peroxidation (LPO) [Snitynskyy, 1999]. Moreover, the intensity of LPO and activity of antioxidant system affect the level of general organism resistance [Savitskiy, 2001].

The weaning is accompanied by a complex of stress factors: lack of sow and breast milk, hunger, change of diet and feeding techniques, etc. The weaning is a high stress, which adversely affects the metabolism and physiological functions in piglet's body [Snitynskyy, 1999]. An important

biochemical mechanism that leads to lower resistance and stress initiation in piglets is long-term activation of free radical oxidation and, especially, lipid peroxidation.

Weaning increases the morbidity and causes the death of piglets in this period, which may even reach 24,8% [Polishchuk, 2004, Drobysheva, 2003]. Thus, all of above determed scientific and practical interest to the problem of reducing the loss of piglets during weaning. It was proved that one of the main reason for this is a stressful condition of piglets, which is primarily due to weaning and changing of diet and facility.

Changing the diet leads to so-called fodder stress [Polishchuk, 2004]. Experienced breeders are well aware that changing the diet of piglets is accompanied by very long (sometimes up to 5-7 days) period of adaptation of animals to consume the new food. Changing the diet dramatically reduces feeding. The adaptive mechanisms initiate the process of energy degradation and stress resistance. Organization of rational feeding of young pigs should be based on full and rapid feeding animals, elevated digestion and maximum efficiency of food nutrients. Unfortunately, even now in most of the domestic pig farms these patterns are not payed attention. Therefore economic efficiency of pork production and profitability remain low. Recent years the zootechnical and physiological validation of feeding programs for suckers and weaned piglets got great emphasis.

One of the most promising way to prevent negative consequences of stress at weaning and to improve organism resistance is the use of biologically active substances in diets for feeding young pigs [Berezhnyuk, 2000].

The most common and cost effective is the feeding of pigs with mixed fodder which contains barley, wheat, corn (energy part), pea seeds and soybean (protein nutrients). Given the fact that during weaning piglets need more full-protein fodder, the authors recommend that when available, except peas, to add higly-efficiently extruded soybeans (15%) [Polishchuk, 2004]. Because of this, maximum nutritional value of fodder can be achieved. But, during prolonged feeding with full-fat soybeans (extruded) in such quantity and more, mix, which contains biologically active agent sodium selenite has to be added in piglet's diet. Sodium selenite is an antioxidant which prevents the accumulation of peroxide compounds in the body [Polishchuk, 2004].

In addition to fodder stress, forming groups of animals from different sows is also stress factor. This leads to the breakdown of adaptive mechanisms, which resuls in lower organism resistance, increasing morbidity and mortality. Therefore, search for new approaches to enhance adaptation and resistance of weaned piglets is very important for modern animal husbandry.

Our data and data of others on the anti-stress effect of melanin were basis for experiments on the use of melanin in the agricultural facilities that specialize in growing pigs.

The aim of the present study is to investigate the effect of melanin on the preservation of pig livestock after weaning.

2. Methods

Investigation was carried on 298 two-months old pigs red-standard specialized lines. 158 pigs were housed in PP "Agroecology", Shyshatsk region, Poltava province (Agroecology group) and 140 pigs - in TzOV "Storozhove", Chutiv region, Poltava province, Ukraine (Storozhove group). Control groups consist of 100 pigs (7-15 kg) from Agroecology and 100 pigs (10-11 kg) from Storozhove. Research groups consist of 58 pig (7-15 kg) from Agroecology and 40 pigs (10-11 kg) from Storozhove. Piglets were weaned around 2 months old. Melanin (0,1 mg/kg, per.os) was given daily 3 days before and 5 days after weaning to research groups. Morbidity and mortality of piglets were recorded daily for 60 following days.

Quantitative results are expressed as mean $\pm$ SD. The statistical significance was determined by Student's t test where appropriate and p values of <0.05 were considered statistically significant.

3. Results and discussion

Percentage of morbidity in Agroecology and Storozhove control groups was 3% and 14%, respectively (Table 1). Thus, preservation was 97% and 86% (average for 2 groups is 91,5±5,5%), respectively. These data supported by Tomin [Tomin, 2007] (preservation at weaning consisted of 86,4 ± 3,70 to 91,5 ± 5,10%) and Drobyshev et al. (75.2%) [Drobyshev 2003].

Melanin abrogated mortality in both research groups which proves the increasing of piglets' organism resistance.

At 3rd day in some pigs, which were given melanin, we registered increased frequency of bowel evacuation which disappeared in 5 days without any treatment. We proposed that this side-effect of melanin might be explained by its prokinetic feature described by Savitski et.al. [Savitskiy, 2001]. He showed dose-and administration-dependent effect of melanin (produced by Nadsoniella nigra var. Hesuelica) on periodic and food gastrointestinal motility and evacuation of carbohydrate-reach food from the stomach in dogs. Melanin in dose of 5 mg/kg, intra-instestinal didn't affect intestinal motility, but significantly increased it after intravenous administration. Melanin in dose of 20 mg/kg, intravenously had 2-phases effect on food motility: 1st phase – short-term inhibition; 2nd phase - significantly increased and prolonged motility of the stomach and intestine. Intraintestinal administration of melanint in dose of 20 mg/kg also enhanced motility of the stomach and intestine. Melanin in dose of 5 mg/kg increased evacuation of carbohydrate-reach food from the stomach, but was not effective at 20 mg/kg. Both 5 and 20 mg / kg doses of melanin enhanced speed of propulsion in small intestine.Others showed that melanin does not affect the speed of gastric fluid evacuation from the gastric in rats [Lin, 1988].

Sensitivity to melanin is probably species-dependent. We used significantly lower dose of melanin (0.1 mg/kg) in comparison to 5 and 20 mg/kg of Savitski's group [Savitskiy, 2001]. But, we have to take into account that we used melanin produced by yeast Nadsoniella nigra strain X-1 which can be more physiologically active melanin. In our prevous study we showed that melanin produced by yeast Nadsoniella nigra strain X-1 was more effective in prevention of stress-induced gastric lesions than melanin produced by black yeast Nadsoniella nigra var. Hesuelica.

Thus, our data suggest that the melanin produced by yeast Nadsoniella nigra strain X-1, is a strong adaptogen and can be widely used in agriculture. The conclusion that this is a good adaptogen, consistent with the literature data that the other melanins possess adaptogen feature too. Thus, biological active compounds of birch fungus, with active compound of fitomelanin use as active biogenic stimulators, that increase organism resistance, stimulate the central nervous and neurohumoral systems, improve metabolism, restore the activity of a delayed enzyme systems [Gorchakov, 1999].

Table

Influence of melanin produced by yeast Nadsoniella nigra strain X-1, on preservation of pig livestock after weaning

№	Experiment	N	Mortality	% Mortality
1	Storozhove control group	100	14	14
2	Storozhove research group (melanin treatment)	40	0	0
3	Agroecology control group	100	3	3
4	Agroecology research group (melanin treatment)	58	0	0

n – number of animals/group.

Thus, our data confirmed the anti-stress effect of melanin, and justified the use of melanin in young growing pigs as stress-corrector during weaning

Conclusions

Administration of melanin produced by yeast Nadsoniella nigra strain X-1 in piglets during their weaning abrogated morbidity and mortality on 100%, that confirmed the increasing resistance of the organism of animals.

References

1. **Berezhnyuk N.** Digestibility of amino acids in pigs when added to the diet glutamic acid /N. Berezhnyuk/Tvarivnitstvo Ukraini. - 2000. - № 1-2. - P. 28.

2. **Gorchakova LA.** Adaptogen impact of fitomelanin to ionizing radiation and stress / LA Gorchakova, LP Derevianko, MY Skachek //Visnik Naukovih Doslidzhen. - 1999. - № 2. -P. 23-27.

3. **Drobysheva F., Vtyuryna E., Palunyna V.** et al. Improving of resistance and preservation of weaned pigs/Svynovodstvo. - 2003. - № 3. - P.24-25.

4. **Polishchuk A.A.** Pathways of effective growing and fattening pigs /AA Polishchuk // Silskiy Hospodar. - 2004. - № 1-2. - P. 25-26.

5. **Savitskiy Ya.M.** Influence of melanin on cytoprotective processes in the mucosa of the stomach / Ya.M Savitsky, V.I. Kimakovych, Y.M. Fedevych// Experimentalna ta Klinichna Phisiologiya i Medicina. - 2001. - № 1. - P. 29-30.

6. **Snitynskyy V.** Activity of antioxidant enzymes and physiological state of piglets under conditions of technological stress / VV Snitynskyy, AE Shah, V. Danchuk / Physiologiya I Biohimiya .- 1999. - № 1. - P.60 - 62.

7. **Tomin E.F.** Age dynamics of growth and development of young pigs of different genotypes in feeding / EF Tomin / / Visnik Agrarnoi Nauki. - 2007 - № 11. – P. 82 - 85.

8. **Lin H.J.** Pseudomelanosis duodeni. Case report and review of literature / HJ Lin, SH Tsay, H. Chiang / / J. Clin. Gastroenterol. - 1988. - V. 10, № 2. - P. 155-159.

9. **Savitskiy Ya.** New data on the action of melanin on gastric acid secretion and gastric mucosa / Ya. Savitskiy, V Kimakovich, T. Beregova / / Programme and Abstracts 4th Parnas Conference "Molecular Mechanisms on Cell Activation: Biological Signals and Their Target Ensymes. - Wroclaw, 2002. - P.108